United States Patent [19]

O'Brien, Jr. et al.

[11] **Patent Number:** 5,675,553

[45] **Date of Patent:** Oct. 7, 1997

[54] **METHOD FOR DATA GAP COMPENSATION**

[75] Inventors: **Francis J. O'Brien, Jr.**, Newport;
Chung T. Nguyen, Bristol; **Sherry E. Hammel**, Little Compton; **Bruce J. Bates**, Portsmouth; **Steven C. Nardone**, Narragansett, all of R.I.

[73] Assignee: **The United States of America as represented by the Secretary of the Navy**, Washington, D.C.

[21] Appl. No.: **682,895**

[22] Filed: **Jun. 28, 1996**

[51] Int. Cl.^{6} **G01S 15/00**
[52] U.S. Cl. **367/135**; 367/136; 367/124
[58] Field of Search 367/136, 135, 367/134, 124; 364/517, 574, 577

[56] **References Cited**

U.S. PATENT DOCUMENTS

5,357,484	10/1994	Bates et al.	367/118
5,373,456	12/1994	Ferkinhoff et al.	364/574
5,471,434	11/1995	Davis et al.	367/124
5,528,555	6/1996	Santos et al.	367/106
5,537,368	7/1996	O'Brien, Jr. et al.	367/135
5,581,490	12/1996	Ferkinhoff et al.	364/574

Primary Examiner—Daniel T. Pihulic
Attorney, Agent, or Firm—Michael J. McGowan; Michael F. Oglo; Prithvi C. Lall

[57] **ABSTRACT**

The present invention comprises a method for filling in missing data intervals in a quantized time-dependent data signal that is generated by, e.g., an underwater acoustic sensing device. In accordance with one embodiment of the invention, this quantized time-dependent data signal is analyzed to determine the number and location of any intervals of missing data, i.e., gaps in the time series data signal caused by noise in the sensing equipment or the local environment. The quantized time-dependent data signal is also modified by a low pass filter to remove any undesirable high frequency noise components within the signal. A plurality of mathematical models are then individually tested to derive an optimum regression curve for that model, relative to a selected portion of the signal data immediately preceding each previously identified data gap. The aforesaid selected portion is empirically determined on the basis of a data base of signal values compiled from actual undersea propagated signals received in cases of known target motion scenarios. An optimum regression curve is that regression curve, linear or nonlinear, for which a mathematical convergence of the model is achieved. Convergence of the model is determined by application of a smallest root-mean-square analysis to each of the plurality of models tested. Once a model possessing the smallest root-mean-square value is derived from among the plurality of models tested, that optimum model is then selected, recorded, and stored for use in filling the data gap. This process is then repeated for each subsequent data gap until all of the identified data gaps are filled.

10 Claims, 6 Drawing Sheets